

FORM PTO-1390  
(REV 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

136.004

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

09/601442 ✓

INTERNATIONAL APPLICATION NO.  
PCT/GB99/00346INTERNATIONAL FILING DATE  
2 February 1999 ✓

PRIORITY DATE CLAIMED

4 February 1998 ✓

TITLE OF INVENTION

WASTE WATER TREATMENT, MEDIA THEREFOR AND ITS MANUFACTURE

APPLICANT(S) FOR DO/EO/US

JOHN JAMES TODD, and ADRIAN HOPWOOD

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern document(s) or information included:**

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A **FIRST** preliminary amendment.  
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

09/601442

INTERNATIONAL APPLICATION NO  
PCT/GB99/00346ATTORNEY'S DOCKET NUMBER  
136.00417. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):**

Neither international preliminary examination fee (37 CFR 1.482)  
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO  
and International Search Report not prepared by the EPO or JPO ..... \$970.00

International preliminary examination fee (37 CFR 1.482) not paid to  
USPTO but International Search Report prepared by the EPO or JPO ..... \$840.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but  
international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$760.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)  
but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$670.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)  
and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$96.00

**ENTER APPROPRIATE BASIC FEE AMOUNT =****CALCULATIONS PTO USE ONLY**

\$ 840

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	16 - 20 =		X \$18.00
Independent claims	2 - 3 =		X \$78.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00

\$

\$

\$ 260

**TOTAL OF ABOVE CALCULATIONS =**

\$ 1100

Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement  
must also be filed (Note 37 CFR 1.9, 1.27, 1.28).

\$

**SUBTOTAL =**

\$

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

+

**TOTAL NATIONAL FEE =**

\$

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

\$

+

**TOTAL FEES ENCLOSED =**

\$ 1100

**Amount to be:****refunded**

\$

**charged**

\$

a. ☒ A check in the amount of \$ 1100 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees.  
A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
overpayment to Deposit Account No. 10-0077. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO

Law Office of Jerome D. Jackson  
211 North Union Street, Suite 100  
Alexandria, Virginia 22314

SIGNATURE

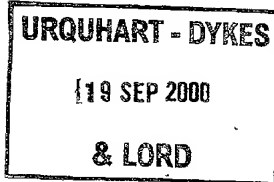
Jerome D. Jackson

NAME

33,186

REGISTRATION NUMBER

2 AUG 00



Attorney's Docket No. 136.004

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) & 1.27(b)) – INDEPENDENT INVENTOR

Applicant: John James TODD  
Serial No.: PCT/GB99/00346  
Filed: February 2, 1999  
Title: WASTE WATER TREATMENT MEDIA THEREFOR AND ITS MANUFACTURE

As a below named inventor, I hereby declare that I qualify as an independent inventor, as defined in 37 CFR 1.9(c) for purposes of paying reduced fees in the Patent and Trademark Office, with regard to the invention described in:

- ☐ the specification filed herewith with title as listed above.
- ☒ the application identified above.
- ☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract of law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.
- ☐ Each such person, concern, or organization is listed below. (Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27))

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that any such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

John James Todd

NAME OF INVENTOR



SIGNATURE OF INVENTOR

16<sup>th</sup> September 2000

DATE

2000 09 16 19:19:40

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) & 1.27(b)) -- INDEPENDENT INVENTOR

Applicant: Adrian HOPWOOD  
Serial No.: 09/601,442 (PCT/GB99/00346)  
Filed: February 2, 1999  
Title: WASTE WATER TREATMENT, MEDIA THEREFOR AND ITS MANUFACTURE

As a below named inventor, I hereby declare that I qualify as an independent inventor, as defined in 37 CFR 1.9(c) for purposes of paying reduced fees in the Patent and Trademark Office, with regard to the invention described in:

☐ the specification filed herewith with title as listed above.

☒ the application identified above.

☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract of law to assign, grant, convey, or license any rights in the invention is listed below:

☐ No such person, concern, or organization exists.

☒ Each such person, concern, or organization is listed below. (Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27))

John James Todd


I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity

is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that any such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Adrian Hopwood

NAME OF INVENTOR



SIGNATURE OF INVENTOR

3 Oct 2000

DATE

Waste Water Treatment, Media Therefor and Its Manufacture

This invention relates to loose particulate material for use in waste water treatment plant and methods, to the manufacture of such material, and to methods and apparatus for the treatment of waste water using such material.

Waste water may be treated by gasification, for example by the aeration or oxygenation of sewage or other waste water containing organic matter degradable by the action of oxygen thereon. A wide range of treatment methods and apparatus has been used and proposed. Oxygen does not dissolve easily or quickly in water and it is therefore in principle desirable to utilize fine bubble aerators wherein the bubbles are less than 2 mm and desirably less than 1 mm in diameter. Smaller bubbles have a larger specific surface area for oxygen transfer into the liquid, and also rise more slowly through the liquid to give a longer time for the oxygen to transfer before the bubble reaches the liquids surface. Treatment plants are known comprising a treatment vessel with aerator devices submerged in the waste water to produce the bubbles.

It has also been proposed to provide a treatment plant where the treatment vessel contains a bed of loose material. Aeration then causes a degree of fluidization of the bed and sustains the growth of a population of microorganisms on the material of the bed. In the presence of dissolved oxygen the microorganisms convert the organic matter in the waste water to carbon dioxide, water and to more bulky cellular materials and sludge thus alleviating the biological oxygen demand (BOD). Under appropriate operating conditions they will also convert ammonia to nitrate compounds. The surplus sludge

thus formed can pass out with the effluent for eventual separation and recycling if desired.

Problems of fouling and clogging of the aerator devices and any pipe work can be acute where they are buried or caged beneath a bed of loose material. Regular closing and draining of the plant for cleaning and unblocking or replacement of the aerators is inefficient and expensive due to the need also to move aside or remove the filter bed material to gain access to the buried aerators.

Our publication no. WO/95/17351 describes a method and apparatus for treatment of waste water wherein such problems are mitigated, and in particular discloses loose particulate material for use as a fluidizable bed in the waste water treatment, said material being characterized by particles of a substantially inert mineral adhered to, coated on or coated by plastics material to provide a habitat for microorganisms effective in waste water treatment.

That Publication discloses such loose particulate material having a density in the range of from substantially 1.0 to substantially 1.3 g/cc, having a specific surface area in excess of approximately 600 m<sup>2</sup> per cubic metre of the loose material, and having a particle size range of substantially 3 mm to substantially 10 mm in diameter. An example of the material is disclosed as particles of sand or other inert mineral particles at least partially adhered to, coated on or coated by plastics material, preferably a thermoplastics material such as polyethylene. It was disclosed that the material could be produced to a desired density for a particular application by changing the initial proportions of mineral and plastics.

Our Publication No. WO/96/25367 describes improved loose particulate material for use in waste water treatment. It



discloses granules of plastics material having grains of an inert mineral such as sand coated thereon, the granules having a predetermined particle size range, and the grains having a predetermined particle size range and being disposed at a predetermined packing density range on the granules. The particles have an average density of approximately 1.0 g/cc such that a proportion tends to float and a proportion tends to sink in the waste water. The particles are manufactured by contacting the granules of plastics material with a mixture of grains of the inert mineral and grains of a soluble substance such as salt, at an elevated temperature, to coat the granules with the mixture, and subsequently dissolving the soluble substance grains from the coating to provide the granules coated with the grains of inert mineral in the predetermined packing density range.

Such loose particulate material has been found in practice to be effective for use in waste water treatment. Such materials have been found to provide a particularly suitable habitat for a high population density of microorganisms of the type effective in waste water treatment.

The inventors have also found that, by using significantly embedded grains, the subsequent step of dissolving away the soluble substance grains leaves concavities in the surface of the granules thereby aiding achievement of the desired high specific surface area.

An object of the present invention is to provide further improved material for waste water treatment and methods for its manufacture.

According to the present invention in one aspect there is provided loose particulate material for use in waste water treatment, said material characterised by granules of plastics material carrying weighting material so that the

particles have an average density of approximately 1.0 g/cc, at least a proportion of said weighting material being carried within the granules, and the surface of the granules being provided with concavities to provide a habitat for microorganisms effective in waste water treatment.

The weighting material, i.e. filler, may be grains of sand, salt, lime, chalk or other substantially inert mineral.

The weighting material is preferably incorporated substantially wholly within the granules such that the weighting material is substantially not exposed at the surface of the granules.

An advantage of incorporating the grains of weighting material largely or wholly within the granules is that the grains can achieve the required weighting function to bring the average particle density to approximately 1.0 g/cc and reducing their likelihood of becoming gradually abraded away over an extended period of use. It is desirable for waste water treatment plants to function for periods of many years between major refits.

If the sand grains are largely exposed on the surface of the granules, as with the particles described in our above-mentioned WO/96/25367, they may become abraded away over a period of use. The proportion of granules of lower density than aerated waste water would then be undesirably increased.

However, the invention includes particles wherein the granules have both weighting material incorporated wholly within the granules and also a surface coating of grains. The weighting material and the surface grains may both be grains of sand or other substantially inert mineral. The surface grains provide convexities thus cooperating with the concavities to increase the specific surface area and thus to increase the habitat area for the microorganisms. A further

advantage of providing some surface grains is that they can effectively prevent the granules from adhering to one another, during manufacture or use, in undesirable agglomerations.

The present invention also provides a method of manufacture of loose particulate material for use in waste water treatment, said method comprising incorporating a weighting material within granules of plastics material so that at least a proportion of the weighting material is carried within the granules and the particles have an average density of approximately 1.0 g/cc, and contacting the granules with grains of a soluble substance, at an elevated temperature, to coat the granules with the soluble substance grains, and subsequently dissolving the soluble substance grains from the coating to provide the surface of the granules with concavities to serve as a habitat for microorganisms effective in waste water treatment.

The grains of a soluble substance can conveniently be salt grains.

The granules are preferably contacted with the soluble substance grains at an elevated temperature such that the grains coat the granules by burying themselves significantly into a partially melted outer surface of the granules, whereby the step of dissolving the soluble substance grains leaves the desired concavities in the granules surface.

In another aspect the present invention provides a waste water treatment medium characterised by a plastics material substrate having a surface provided with concavities to provide a habitat for microorganisms effective in waste water treatment.

The medium may be a structure adapted to be fixed in position within a waste water treatment vessel.

In yet a further aspect, the present invention provides a method of manufacture of a waste water treatment medium comprising contacting a plastics material substrate with grains of a soluble substance, at an elevated temperature, to coat the substrate with the soluble substance grains, and subsequently dissolving the soluble substance grains from the coating to provide the surface of the substrate with concavities to serve as a habitat for microorganisms effective in waste water treatment.

An embodiment of the invention will now be described.

Granules of plastics material are provided. These are suitably granules of polyethylene and preferably have substantially uniform particle size. The particle size is suitably in the range 3 to 10 mm considered as a sieve size range. The preferred size range is 4 to 8 mm, preferably about 6 mm. The granules may be of approximately spherical, ellipsoidal or cylindrical shape, or may be of irregular shape such as commercially available recycled chips, for example granulated from moulded rejects. Flattened shapes have a greater specific surface area.

It is desired to achieve a high specific surface area for the loose particulate material, for example in excess of about 600 m<sup>2</sup> per cubic metre or even 2000 m<sup>2</sup> per cubic metre. The greater the specific surface area, the correspondingly larger is the habitat area for the microorganisms effective in the treatment.

The specific gravity of the plastics material is fixed by the choice of plastics material, suitably polyethylene, and is less than 1.0 g/cc. The granules carry weighting materials so that the particles have an average density of approximately 1.0 g/cc. Thus in use a proportion of particles tend to float and a proportion tend to sink in the

waste water, but on average have neutral buoyancy so as to circulate easily as the waste water is aerated and circulated. The density is preferably a little less than 1.0 g/cc because aerated waste water itself has a density a little less than 1.0 g/cc.

The weighting material is suitably grains of sand and is preferably incorporated substantially wholly within the granules. However the invention includes embodiments wherein the granules have sand grains incorporated wholly within the granules and also a surface coating of sand grains. The specific gravity of the mineral, e.g. sharp sand, is substantially greater than 1.0 g/cc and thus the relative quantity of said grains to be incorporated in the granules is determined by the specific gravity of the plastics material to bring the resultant particles up to the desired density of approximately 1.0 g/cc.

The surface of the weighted granules is provided with concavities to serve as habitats for microorganisms effective in waste water treatment. The concavities preferably cover substantially the whole surface of the granules, thereby providing the greatest possible increase in effective surface area.

The concavities may be about 0.1 mm to 1 mm in effective width and in effective depth, preferably about 0.3 mm in width and a little less in depth. It will be appreciated that if such concavities cover substantially the whole surface of the granules then the specific surface area is increased by a factor of about 3 or more, also depending upon the general shape and regularity of the concavities themselves.

The concavities not only increase the specific surface area, and thus the available habitat area for the

microorganisms, but they also provide a sheltered environment which particularly favours the growth of a desirably dense and stable population of microorganisms. In prior art arrangements with microorganisms exposed on the external surfaces of media or structures, they are liable to become detached by abrasion or tumbling during circulation of waste water.

A particular advantage of the particles of the present invention is that they are loose and of neutral buoyancy, and are thus continually mobile within and throughout the body of waste water within the treatment vessel. Thus, during circulation and aeration this ensures high efficiency of contact between the microorganisms and the waste water being treated.

However, an advantage of the invention can also be achieved in relation to other waste water treatment media, for example structures adapted to be fixed in position within a waste water treatment vessel. Such medium is also preferably a plastics material and has a surface similarly provided with said concavities to provide a habitat for microorganisms effective in waste water treatment.

The loose particulate material is suitably manufactured by incorporating the weighting material within the plastics material granules and then creating the surface concavities. The weighted granules are contacted with grains of a soluble substance, at an elevated temperature, to coat the weighted granules with the soluble substance grains, and subsequently dissolving the soluble substance grains from the coating to provide the surface of the granules with the concavities.

The soluble substance may be common salt, i.e. sodium chloride. The salt grain size range is of course governed by the desired size of the eventual concavities and is suitably

about 0.3 mm. Salt grains tend to be cubic crystals and thus the eventual concavities also tend to be generally cubic. This is advantageous in increasing the specific surface area.

The soluble substance may however be any economically available granular substance which is soluble in a common solvent, such as water, that does not affect the plastics material and provided that it has a melting point higher than the softening point of the polyethylene granules, i.e. higher than about 200°C.

The weighting material may be identical to the soluble substance. For example, both may be common salt grains. The salt grains incorporated within the granules as weighting material would thereby tend to be protected from being dissolved away by the waste water.

It has been found possible to provide loose particulate material having a specific surface area considerably in excess of 600 m<sup>2</sup> per cubic metre, i.e. up to 3000 m<sup>2</sup> per cubic metre or 4000 m<sup>2</sup> per cubic metre. Moreover, the concavities provide a sheltered environment which particularly favours the growth of a desirably dense and stable population of microorganisms. The material finds use in waste water treatment plants and methods for example as described in our above-mentioned WO/95/17351 or WO/96/25367.

Claims

1. Loose particulate material for use in waste water treatment, said material characterised by granules of plastics material carrying weighting material so that the particles have an average density of approximately 1.0g/cc, at least a proportion of said weighting material being carried within the granules, and the surfaces of the granules being provided with concavities to provide a habitat for microorganisms effective in waste water treatment.
2. Loose particulate material according to claim 1, in which the weighting material is incorporated substantially wholly within the granules such that the weighting material is substantially not exposed at the surfaces of the granules.
3. Loose particulate material according to claim 1 or claim 2 in which the weighting material is salt grains.
4. Loose particulate material according to claim 1, in which the weighting material is incorporated within the granules and adhered to the surfaces of the granules.
5. Loose particulate material according to claim 1 or claim 4, in which the weighting material is sand grains.
6. Loose particulate material according to any preceding claim, in which the weighting material is a mixture of sand and salt grains.



7. A method of manufacture of loose particulate material for use in waste water treatment, said method comprising incorporating a weighting material within granules of plastics material so that at least a proportion of the weighting material is carried within the granules and the particles have an average density of approximately 1.0g/cc, and contacting the granules with grains of a soluble substance, at an elevated temperature, to coat the granules with the soluble substance grains, and subsequently dissolving the soluble substance grains from the coating to provide the surfaces of the granules with concavities to serve as a habitat for microorganisms effective in waste water treatment.

8. A method according to claim 7, in which the soluble substance grains are salt grains.

9. A waste water treatment method characterised by charging a treatment vessel with waste water and loose particulate material according to any one of claims 1 to 6, and aerating the waste water by means of aerators.

Please type a plus sign (+) inside this box → ☐

PTO/SB/01 (12-97)

Approved for use through 8/30/00. OMB 0851-0032

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b> <b>(37 CFR 1.63)</b>  <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing      OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	136.004
	First Named Inventor	TODD, John James
	<b>COMPLETE IF KNOWN</b>	
	Application Number	PCT/GB99/00346
	Filing Date	February 2, 1999
	Group Art Unit	
Examiner Name		

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**WASTE WATER TREATMENT, MEDIA THEREFOR AND ITS MANUFACTURE**

the specification of which

(Title of the invention)

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 2/2/99 as United States Application Number or PCT International

Application Number PCT/GB99/00346 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
9802388.0	GB	2/4/98	<input type="checkbox"/>	YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 3]

Burden Hour Statement: This form is estimated to take 0.4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

Please type a plus sign (+) inside this box → ☐PTO/SB/01 (12-97)  
Approved for use through 9/30/00. OMB 0651-0032  
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

**DECLARATION — Utility or Design Patent Application**

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT International application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number  OR ☒ Registered practitioner(s) name/registration number listed below

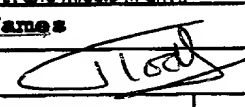
Place Customer Number Bar Code Label here

Name	Registration Number	Name	Registration Number
Jerome D. Jackson	33,186		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.Direct all correspondence to: ☐ Customer Number  OR ☒ Correspondence address below

Name	Law Office of Jerome D. Jackson				
Address	211 North Union Street, Suite 100				
Address					
City	Alexandria	State	VA	ZIP	22314
Country	US	Telephone	703-684-4840	Fax	703-684-4858

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:		<input type="checkbox"/> A petition filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
John James		Todd	
Inventor's Signature			Date
			11.9.00
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☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto


Please type a plus sign (+) inside this box → +

PTO/SB/02A (3-97)  
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## DECLARATION

ADDITIONAL INVENTOR(S)  
Supplemental Sheet  
Page 3 of 3

<b>Name of Additional Joint Inventor, if any:</b>				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
<u>Adrian</u>				<u>Hopwood</u>			
Inventor's Signature				Date		5 Oct 2000	
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				GB		Citizenship	
				GB			
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<b>Name of Additional Joint Inventor, if any:</b>				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature				Date			
Residence: City				State		Country	
						Citizenship	
Post Office Address							
Post Office Address							
City				State		ZIP	
						Country	
<b>Name of Additional Joint Inventor, if any:</b>				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature				Date			
Residence: City				State		Country	
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